Stories from the Field

International Potato Center
Annual Report 2000

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Contents

SETTING THE COURSE

The year 2000 presented a series of opportunities, challenges and successes that helped CIP increase our strengths, sharpen our focus and set a clear course for the future. As is appropriate for a millennial year, it was a time of renewal, allowing us to enter 2001, the 30th anniversary of our foundation, knowing that we continue to help reduce poverty and increase food security for the poorest people of the world. Today, annual net return from the Center's research investment is conservatively estimated at about US$150 million a year. And that is only 30–40 percent of the impact CIP research will have as the full benefits from our breeding efforts begin to be felt around the globe.

Thirty years ago the International Potato Center was founded on the principle of hands-on cooperation. Since that time, we have worked shoulder-to-shoulder with our partners and stakeholders in fields, laboratories and advanced research institutions throughout the world. Today we can attest to the effectiveness of that principal of partnership. Shared goals, work and resources are producing substantive benefits for people in developing nations, as the *Stories from the field* in this Annual Report so eloquently relate.

Thanks to dramatic growth in potato production in developing countries, poor farmers have been able to increase their incomes, and thereby improve their families' livelihoods and diversify their diets. Our story from Kabale, Uganda, entitled *Convincing quality: Farmer seed systems catch on* (page 18) illustrates the many areas of research that converge in farmer-based seed systems to make better lives a reality. Sweetpotato is rapidly gaining recognition as a valuable food for both people and animals and as a source of raw materials

for industry. This root crop's growing importance as a key contributor to CIP's success has been documented in numerous impact studies, and its flexibility can be seen in several stories in this Annual Report. The Andean roots and tubers that we have helped to protect from extinction are increasingly being recognized as important sources of nutrition and income for poor Andean farmers. A case in point is arracacha. CIP's partnership with the Consortium for Sustainable Development in the Andes (CONDESAN) to develop this crop's potential is described in *Arracacha: A lost crop finds its way to the market* (page 30).

CIP's highly relevant research projects make possible these direct improvements in the livelihoods of poor farm families. In work on potato during 2000, Center scientists identified and improved new sources of resistance to late blight disease from species related to the potato. They bred more than 30 new potatoes, all highly resistant to late blight, and distributed them to a number of developing countries. National programs in developing countries selected at least five new varieties of potatoes from CIP's plant breeding material and released these to their farmers.

In sweetpotato, biotechnology helped to identify genes associated with desirable traits for yield and use; genetic engineering generated plants resistant to viruses and to a terribly damaging weevil pest; and five native varieties of sweetpotato were released in Africa after farmers, working alongside CIP scientists, helped to evaluate their performance.

Most important, impact studies showed that the full benefits of CIP technologies have yet to be realized. To date, the impact of CIP research has been

most visible in the reduction of production losses through improved seed systems, integrated pest and disease management, and post-harvest handling. But a dramatic growth in productivity is beginning to be seen in developing nations around the world thanks to the new varieties resulting from CIP's research on plant breeding.

Along with these exciting successes, 2000 also presented serious challenges. Early in the year, unexpected commitment reductions from key sources forced CIP management to take rapid action, reevaluating both programs and resource allocation. Although the Center received extra support from donors as well as from the Finance Committee of the Consultative Group on International Agricultural Research (CGIAR), it was clear that this would not be sufficient to cover the losses without also effecting reductions to an already lean budget and, regrettably, staff. After a rigorous review of program priorities, we had to let go some 15 percent of our internationally recruited colleagues, including many who had been with us for more than a decade.

CIP emerged from this process with a much sharper definition of its agenda and targets. By reducing the number of projects from 17 to 13, we have been able to increase research integration and regroup our staff into more efficient and effective research teams. Some fine-tuning remains to be done, but we have achieved a great deal and our staff deserve recognition for having willingly shouldered this immense task on top of an already full workload.

In the wider context of CGIAR reform, we are putting into place mechanisms that will help us to set our course for the future, such as regional consultative

workshops on our major program areas. We have sharpened our focus on poverty reduction, and will devote greater effort and more resources to programs aimed at directly benefiting the very poor. These include the Strategic Initiative on Urban and Peri-urban Agriculture (SIUPA), the VITAA (vitamin A for Africa) project for increased use of orange-fleshed sweetpotatoes in Sub-Saharan Africa, and the Global Mountain Program (GMP). We have also identified more effective ways of helping national programs and responding to international calls for assistance in disasters.

In the coming decades, the contribution of roots and tubers to satisfying global food needs will continue to grow. As the CGIAR reviews and updates its institutional and programmatic framework, we have no doubt that CIP's critical role in this growth process will be fully recognized and endorsed. As we help to realize the promise of new technologies, 30 years in the field have shown us that our experience with farmers and scientists worldwide, our extensive networks, and our emphasis on holistic approaches to farming and resources systems will continue to prove critical in providing sustainable solutions.

Today CIP is preparing to meet the challenges ahead in direct consultation with our Future Harvest partners and stakeholders at local, national and regional levels. But we are doing so without losing sight of the bigger picture. The global implications of many of our efforts — in germplasm conservation, urban agriculture, natural resources management, and late blight, for instance — will provide essential underpinning to our local and regional undertakings.

In closing, I would like to recall that the year 2000 was also a year of celebration for CIP. The celebration began in late 1999 with the reaffirmation of our relevance through the signing of an agreement granting the Center full legal status as an international organization. This was followed, in March 2000, by the renovation of our agreement with the government of our host country, Peru. These institutional milestones — commemorated in the book *The Potato, Treasure of the Andes* — substantiate the excellent relationship that CIP has maintained with its loyal supporters over three decades.

In this Annual Report to our stakeholders, we have brought together testimonies of CIP's presence in the lives of the people we work with and for in Africa, Asia and Latin America. You will see their faces and read their accounts in the pages that follow. Our research achievements will be reported in more detail in our 1999–2000 Program Report, to be published in September 2000. Meanwhile, we hope these *Stories from the field* will help to convey CIP's adherence to our founding principles, their successful application in ensuring better livelihoods, and their value and relevance for the future.

Hubert Zandstra
Director General

FORMULA FOR SUCCESS: SWEETPOTATO-BASED FEED IN VIETNAM

Ta Van Hien was skeptical at first. The idea of mixing chicken manure and sweetpotato roots with fishmeal and soybeans — and then allowing the concoction to ferment — was a radical departure from the chopped and boiled sweetpotato recipe he and his family had been using to feed their pigs for generations.

Six months later, Hien is a convert to the process. "I thought it was strange at first, but now I have no doubts," he says. "The pigs are growing faster, their skins are shinier and best of all, it takes a lot less time to prepare feed for them."

Since CIP began trials on five farms in Pho Yen Province in 1999, sweetpotato fermentation has fueled a mini-revolution among the farmers of the Dong Tien commune and throughout Vietnam.

Fermentation is particularly good news for women farmers, as it liberates them from the drudgery of preparing — three times a day — the boiled feed alternative. This not only improves the quality of these women's lives, and those of their families; the resulting boost in women's production capacity is expected to bring numerous benefits to households and communities throughout the country.

In Pho Yen, in the Red River Delta 70 km north of Hanoi, locals estimate that as many as 30 percent of the province's farms are now using some form of fermentation, not only with sweetpotatoes but also with cassava roots. And word of the Pho Yen villagers' success has spread to other parts of Vietnam. After commune leaders from neighboring Bac Giang Province visited the trial sites, for example, they invited Hien to Bac Giang to demonstrate the technique to 70 local farmers.

"FERMENTATION IS PARTICULARLY GOOD NEWS FOR WOMEN FARMERS, AS IT LIBERATES THEM FROM THE DRUDGERY OF PREPARING . . . THE BOILED FEED ALTERNATIVE."

In Thanh Hoa Province, leaders of the Hai Linh commune, one of the biggest sweetpotato and pig-raising communities in Vietnam, organized a meeting to inform farmers about the technology. Now, every farmstead there has begun to ferment sweetpotato. And Vietnamese state television, reacting to the successes, is now planning to highlight the process on its science and technology channel.

More for less

"Using fermentation can help farmers in Asia and Africa — and in just about any place where sweetpotato is used as pig feed," said Dai Peters, the CIP scientist who, with Nguyen Thi Tinh from Vietnam's National Institute of Animal Husbandry, created the formula and designed the trials. "It allows farmers to raise healthier, larger animals in less time."

The method is very popular both because it is easy to prepare and because it fattens animals quickly. Better yet, farmers say, it uses locally available raw materials and requires little capital investment or equipment.

"It has gone so well that we tried feeding the mix to our ducks and hens," said Truong Thi Thoan, a neighboring farmer who was taught the formula by Hien. "Now they're getting fatter too."

Until now, raising pigs has been something of a money-losing proposition, making large-scale breeding an option open only to wealthy farmers. Traditionally, farmers in most of northern and central Vietnam boil sweetpotato roots and vines to make the feed they use to raise their pigs. Boiling is essential because it breaks down trypsin inhibitors, which otherwise would prevent the animal from assimilating nutrients.

The problem with the boiled method is that it is onerously time consuming. The farmers, usually women, must spend several hours every day chopping the ingredients, gathering fuel and doing the cooking.

In addition, large amounts of sweetpotatoes need to be stored for use in the off-season. This presents a host of additional problems, as the stored roots often come under attack from weevils, rats and rot, and farmers may lose as much as half their stored feed.

The fermented mix introduced by CIP helps farmers make the most of their work and investment. Like boiling, fermentation breaks down trypsin inhibitors. But because the fermented mix can be prepared in one large lot and stored for months,

farmers using this method achieve considerable savings in labor, fuel, water and cooking time. In addition, these farmers can process their sweetpotatoes immediately after the harvest, when labor is more abundant, and save the mixture for use when other feed is limited and more expensive.

Small change, big returns

This small change in the way farmers in northern and central Vietnam prepare pig feed represents a large technological and commercial leap forward. The ramifications, in terms of pig-raising potential, have not been lost on the Pho Yen farmers.

"I'm planning to take this to an industrial level," said woman farmer Nguyen Thi Ty. "It's so much easier now." Ty's growing pig business is proof. After participating in one of the CIP trials, she added two sows to her stock of six. Today Ty has 11 piglets that she intends to fatten and sell. To feed them she has mixed up one tonne of fermented mix — a two-and-a-half-day job — that should provide her with feed until the pigs are grown and ready for market. Now that her main labor and time constraints have been removed, Ty sees almost boundless potential.

Neighbor Truang Duc Cai has similar plans. A year ago, Cai had six pigs. Today, he has 11, and after this lot goes to market he plans to expand to 20, even 25.

"Eleven pigs each weighing 100 kg at 10,000 dong (US$0.69) a kilogram, that's a million dong (US$69)," Cai says, eagerly putting the numbers together. "At this rate, it's probably more beneficial to plant sweetpotato than rice. It doesn't require a lot of investment and there's no great risk."

That is because it is an excellent time to come into the market. Demand for meat in Vietnam is on the upswing, expected to grow from 33,000 tonnes in 1999 to 87,000 tonnes by 2005 and 119,600 tonnes by 2010. Greater output from the hilly farms around Pho Yen will help meet the demand while increasing villagers' economic strength and giving them more control over prices. At present, they are at the mercy of the middlemen who buy their stock at the farmgate.

Something for everyone

Only about 20 percent of Vietnam's farmers, however, can afford the fishmeal, chicken manure and soybean additives included in the feed formula. For the other 80 percent, whom the Vietnamese government classifies as 'disadvantaged', the cost of the additives is a major stumbling block. In fact, in order to ensure that the trials responded to actual opportunities and conditions, CIP chose for these only farmers who had enough resources to afford the basic investment.

BANKING ON EFFICIENCY

Pigs. In some cultures they are disparaged. But Vietnamese farmers, they say, follow in their footsteps. That is because in this rural society, where many eke out only a meager existence, pigs are a flesh and blood promise of a better future.

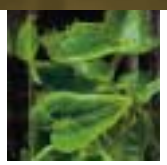
"They are literally piggy banks," says post-harvest specialist Dai Peters. "Pigs provide farmers with just about their only source of cash. And their manure fertilizes the fields and helps maintain the integrity of the soil."

What's more, there are signs that Vietnam's farmers are beginning to see, and bank on, the profound influence of the 'livestock revolution' that has been sweeping the developing world for the last two decades. By 2020, the global demand for meat and dairy products will more than double, with developing countries accounting for the bulk of the increase in consumption.

This boost is expected to bring manifold benefits, most importantly reduced hunger and malnutrition, and sweetpotatoes are a vital part of this equation. In Vietnam, as in many Asian countries, sweetpotatoes are the most important source of pig feed.

Yet, greater meat production has its drawbacks. Already, industrial livestock production systems have developed in response to the rising meat consumption trend, often with negative consequences for the environment and for the livelihoods of poor, small-scale producers.

Simple, efficient technologies like the ones tested by CIP and its collaborators in Pho Yen can help them to make the most of the livestock revolution while protecting precious natural resources.



From theory to practice

Farmer field school (FFS) development is an important component of CIP's sweetpotato integrated pest and crop management research in Asia. It contributes to the creation of solid mechanisms for carrying research output to national programs for dissemination.

Field schools were originally designed to help Asian farmers enhance their knowledge and skills in rice pest management. CIP and its partners, recognizing the effectiveness of these schools and knowing that many countries in the region have strong national cadres of FFS facilitators, seized a golden opportunity to adapt the field school model for sweetpotato crop management. Initial experiences in Indonesia met with great success: participants in pilot schools averaged a 24 percent increase in their net sweetpotato income.

Researchers, farmers and field school facilitators in Vietnam decided to adapt the technical crop management guidelines and FFS learning activities developed in Indonesia to local needs and circumstances. This meant looking at prevailing sweetpotato production and utilization patterns, which are very different from those in Indonesia. Both vines and storage roots are used, particularly for animal feed, and the pest complex is somewhat different, as are harvesting and marketing practices.

CIP and its partners organized participatory studies and pilot field schools in eight locations throughout Vietnam and produced a manual in Vietnamese. The country's Ministry of Agriculture and Rural Development (MARD) intends to use the manual to scale up field school activity across Vietnam. The project for feed development described in the main story is also working to incorporate its findings into the field school curriculum.

Nonetheless, financial limitations have not kept resource-poor farmers from taking advantage of the fermentation idea. A case in point is Truong Cong Phan, who began experimenting with fermentation techniques after he witnessed a neighbor's pigs growing fat on the CIP feed mix. Instead of chicken manure, Phan used rice bran as the fermentation agent and his two pigs went without the soybean and fishmeal supplements.

Phan considers his experiment a success. The 53-year-old — who like his parents has been raising pigs all his life — says he doesn't expect his pigs to grow as big as his neighbor's, but he is very pleased with the CIP-introduced technique. Labor savings are still enormous, and the longevity of the feed means he can make more of his sweetpotato crop. Peters feels that this adaptability is one of the primary advantages of the process. "The benefits of fermented sweetpotato are independent of the balanced diet additives," she says, "even though using the two in combination gives the best results."

Since completing the first round of trials, Peters and her collaborators have been holding extension meetings to get the word out on the fermentation technique. The response, she says, has been enthusiastic and Peters is confident the process is ready for wider implementation throughout Vietnam.

Standing in the small concrete-floored room he uses for storage, Hien has no doubt Peters is right. Dipping his arms into a polyurethane bag he pulls out a double handful of the powerful-smelling yellow mash and eagerly offers it to visitors to sniff. To Hien, it is the smell of success.

— reported by Chris Bursle

Turning sweetpotato into gold

In 1992, inspired by researchers from the International Potato Center, Zhou Guang-you founded the Guang-you Ltd. sweetpotato noodle company with an initial investment of US$60. Eight years later, Zhou is a millionaire.

The secret to his success, and to a revolution in noodle making in China, lies in an amazing value adding equation: *6 kg fresh sweetpotato (US$0.25) = 1 kg starch = 14 packs of instant noodles (US$5).*

Today, Zhou owns 19 patents for sweetpotato noodle processing and Guang-you Ltd. is a US$5 million company. One of the largest sweetpotato enterprises in China, it employs 500 people, has an annual production capacity of 10,000 tonnes of instant noodles and is the driving force behind the promise of better incomes for 500,000 sweetpotato farmers in Sichuan Province.

Since sweetpotato was introduced into China 400 years ago, this South American crop has become a lifeline there. The country has 6 million hectares dedicated to the crop and produces 121 million tonnes yearly, about 86 percent of the world's sweetpotatoes. The Sichuan basin (including Chongqing and Sichuan provinces) leads national production.

Sweetpotatoes, however, are not something Sichuan people have always been proud of. With little commercialization or added value, the crop has long been a symbol of poverty and ignorance. According to provincial statistics, 70 percent of Sichuan's 1997 sweetpotato crop was used to feed pigs in subsistence farming systems. Throughout China, sweetpotato typically has brought in only half or even one-third the profits of rice.

Zhou grew up in the poor, sweetpotato-producing county of Shantai, Sichuan. Like many people from this area, he had mixed feelings about the crop because it was a reminder of difficult times. His professional experience, however, helped him to see it in a new light.

After earning a degree in food science, Zhou worked in various government jobs putting farmers in touch with agricultural technologies that could make a positive difference in their livelihoods. One of these jobs was in Ganba, a poor district in Shantai, where one of the few income generators for local farmers was processing sweetpotato into starchy noodles.

Researchers from the International Potato Center visited Ganba in 1990 during a trip to China to study sweetpotato post-harvest practices. Zhou accompanied them on their tour and, after a few days with the experts, began to see the potential of this crop. Two years later, when CIP scientists and colleagues from the Sichuan Academy of Agricultural Sciences organized a sweetpotato processing course in Zhou's hometown, he quickly signed up. The course was another eye opener.

At that time, the market was full of instant noodles made from wheat flour — a popular food for millions of Chinese people. Zhou recognized the potential demand for a similar product using sweetpotato starch, and worked this vision into a money-making proposition. His calculations were crystal clear: from sweetpotato to starch, value increased by 100 percent; from starch to normal starch noodles, by 200 percent. If the starch were to be processed into instant noodles, a 2000 percent value increase could be achieved.

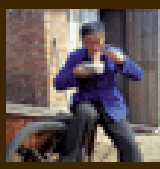
One month after the course, Zhou quit his government job to start a small noodle factory. With his factory in full production, Zhou continued to develop the processing technology. He invented a starch extraction machine — the 'Guang-you mini-machine' — that processes 2 tonnes of fresh sweetpotato per day, 20 times more than the traditional, labor-intensive manual method.

The new technology has transformed sweetpotato noodles from a low-value rural commodity into a high-quality food product. The processing machine enables year-round noodle production and, more important, is well suited to small, family level processing.

Zhou says that farmers' fields are his principal workshop. His company provides training in topics that range from variety selection to post-harvest handling. For example, because he depends on local farmers for the production of raw starch, he helps ensure that production is stable by giving two processing courses per month.

To date, 4,000 Guang-you machines have been sold in China. Some 1,000 demonstration sites support sweetpotato growers. From Yunan to Inner Mongolia, potato and cassava producers are using similar technologies, bringing the national impact to about US$40 million.

As Guang-you noodles expand into international markets — in India and Russia, for instance — the company's fame is attracting visitors from home and abroad. Zhou does not plan to rest on his laurels. Guang-you Ltd.'s second phase of expansion, just completed, is expected to increase noodle production by 200 percent and generate annual gross income of US$25 million. With that money, Zhou plans to build four more processing plants in western China and to draw more sweetpotato farmers into the enterprise.



The key to his success, according to Zhou, is that he builds on the healthy mutual interests of his company and the farmers. His neighbors from Shantai can testify to the value of this principle: 40 sweetpotato starch processors from one Shantai village produced 200 tonnes of raw starch for his factory last year, generating US$2,000 extra income per family.

— reported by Chen Lan

New from Toyota: Sweetpotatoes

The name Toyota may have you thinking about cars, but the Japanese automobile corporation is branching out these days — into sweetpotatoes.

Thanks in part to collaborative research with CIP scientists, Toyota will turn sweetpotatoes into animal feed pellets, bio-degradable plastics and other products at a new agroprocessing plant in Lampung Province of southern Sumatra, Indonesia. Slated to open by September 2002, the factory is expected to process 250,000 tonnes of sweetpotato per year.

The project got off the ground several years ago when Toyota asked Technova Inc., a private Japanese company dedicated to industry research, to look into the financial potential of a sweetpotato processing business in Southeast Asia. Realizing that the first step was finding sweetpotatoes with the right characteristics for the industrial products they wanted to make, Technova executives sought the help of CIP's regional office in Bogor, Indonesia. In 1999 CIP scientists put together a two-year program to study sweetpotato cultivation in Indonesia, test the performance of varieties, and develop rapid multiplication techniques for planting material.

Trials carried out in several locations in Java and Sumatra were successful enough for Toyota to decide to go ahead with their investment. It's good business for the car manufacturer and it's good news for Indonesian farmers. Research shows that Toyota's investment will increase Indonesian sweetpotato production by more than 10 percent, giving Lampung farmers a new and more stable market for their crops.

CONVINCING QUALITY: FARMER SEED SYSTEMS CATCH ON

John Bangirana's three teenaged children are in secondary school today thanks in large part to seed potatoes.

Two years ago, the development agency AFRICARE gave Bangirana — a farmer in the tiny southwestern Uganda village of Kabira (district of Kabale) — 60 kg of 'clean', disease-free tubers from a program organized by Uganda's National Agricultural Research Organization (NARO) in conjunction with CIP.

"From that 60 kg, we got eight bags," says Bangirana. "We sold three, planted five and generated another 23 bags. Then we sold 18 bags at 20,000 shillings (US$12) each." Without that income, Bangirana wonders how he would have paid the US$200 per term it costs to keep his children in school. "I don't think I could have made it," he says. "Now I don't want to sell ware potatoes anymore, I want to sell seed."

In Kabale and across Uganda, NARO and CIP are helping farmers like Bangirana get involved in producing seed. The aim is to make up for the generalized shortage of quality seed. This has long been one of the biggest constraints on the country's potato production.

"Clean seed is very scarce," says Berga Lemaga, coordinator of PRAPACE, the Regional Potato and Sweetpotato Improvement Program for East and Central Africa. "The area is infested with bacterial wilt. It's the number one threat to potato production in Kabale."

And that's a major problem. Potato is the primary cash crop in Kabale, 400 km southwest of the capital city Kampala. In fact, the district accounts for about 40 percent of Uganda's potato production. Although people depend more on beans, sweetpotatoes, sorghum and field peas for food security, potatoes bring in scarce cash.

"WHAT WE'D LIKE TO SEE IS A GRADUAL IMPROVEMENT IN THE QUALITY OF SEED THROUGH FARMER-BASED PRODUCTION . . . ."

The vast majority of Ugandan potato farmers use two methods to obtain seed. Either they set aside some of the smallest potatoes from their harvest for the next season's seed, or they buy seed potatoes from local markets. Both of these practices promote the spread of bacterial wilt, a devastating plague that lurks in contaminated seed and soil.

CLEANING UP

"That's how the wilt is spread," explains Lemaga. "The farmers don't know the source of the seed

from the market, so they end up planting diseased seed and spreading the wilt to their own soil."

Because of high population density and small average landholdings — about one hectare per family — most of Kabale's farmers are unable to practice proper crop rotation and fallow techniques. As a result, soil fertility is diminished and diseases such as bacterial wilt and late blight spread more easily. There is great demand for clean seed in Uganda, but the national potato program cannot meet it. NARO's Kalengyere Research Station produces only about 500 bags (about 40 tonnes) of 'basic' seed each season. This is enough to plant just 35 to 40 hectares.

The production of clean seed involves several stages. First, what is known as pre-basic seed must be produced from 'mother' plants that are grown under exacting phytosanitary conditions and have been thoroughly tested to ensure that they are free of pathogens. The resulting tubers are then planted in the field to generate basic seed, which can be used for several generations to produce quality seed tubers.

Multiplier effect

NARO and CIP came up with the idea to multiply the effect of the national program by introducing farmer-based seed systems. Such systems are the norm in Andean Latin America, with its long history of potato growing, but were all but unknown in Africa. "What we'd like to see is a gradual improvement in the quality of seed through farmer-based production rather than centralized state action," explains Peter Ewell, CIP's regional representative for Sub-Saharan Africa.

The result is the Uganda National Seed Potato Producers' Association (UNSPPA). It began in 1997 with just 10 farmers who had enough land for adequate crop rotation. Each season since then, the farmers have received clean basic seed from NARO, multiplied it, then sold it to farmers in Kabale and other neighboring districts.

Since it started, UNSPPA has produced as much as 700 bags of improved seed a season and its membership has climbed to 26. CIP and PRAPACE have worked closely with NARO in the selection of appropriate varieties and the production of basic

seed. One of UNSPPA's biggest challenges has been persuading ordinary farmers to buy their more expensive, improved seed rather than getting the cheaper product from local markets or simply using home-saved seed.

"We have set up demonstrations at different locations with local home-saved seed versus the improved seed so that farmers can come and see the difference themselves," says chairman Stephen Tindimubona. The typical multiplier effect for improved seed here is 10:1, versus 3:1 for home-saved seed. "At the same time, our own fields act as demonstration fields. When we harvest, people come to see our yields and when they compare them to their own production they see a big difference."

As well as providing a necessary service to other farmers, UNSPPA members are finding out that seed production is a profitable venture. In its best season, the association made a profit of 19.6 million shillings (about US$11,700). Members also are benefiting from their ability to market their seed as a group and from the fact that they now can buy reliable fungicides, insecticides and fertilizers collectively from the capital city, rather than depend on the uncertain quality of those available locally.

UNSPPA continues to seek the entry of more farmers into the seed-producing business. The association is still small and its annual production

Latent threat

Bacterial wilt, caused by *Ralstonia solanacearum*, is the second most damaging potato disease (after late blight) in tropical and subtropical areas. Uganda is one of the countries hardest hit by this disease.

The disease, which affects potato production on about 1.5 million hectares, is spread mainly through the use of seed tubers with latent infection. Although seed produced in cool, highland areas may not show bacterial wilt symptoms, when these same tubers are planted in the warmer lowlands, the disease flourishes. For this reason, monitoring of *R. solanacearum* infection in apparently healthy seed tubers is a major component of bacterial wilt control.

CIP is helping to increase the efficiency of seed production systems with a sensitive, easy-to-use and low-cost technique for detecting *R. solanacearum* infection in tubers. Kits developed at CIP are used in basic-seed production systems worldwide to ensure that only bacterial-wilt-free tubers are distributed to growers. In Kalengyere, Kabale, the kit also is making it easier for scientists to gather data on the rate of infestation at different stages in the seed chain. Recent experiments in Bolivia and Peru have helped determine the optimum sample size for this type of testing. Another sampling strategy has been developed to support the search for resistance to bacterial wilt in potato germplasm collections.

Integrated management of bacterial wilt is being promoted through on-farm education and research. While the focus is on enhancing production and use of healthy seed, knowledge of disease epidemiology and use of control measures such as improved crop rotation systems also are emphasized. The results so far are encouraging: yield increases on the small farms involved range from 60 to 165 percent.

Knowledge on the ground

Late blight is a threat to potato production all over the world, but can be particularly devastating for resource-poor potato farmers in developing countries. One of the keys to late blight control is the selection and dissemination of quality seed. CIP has more than 50 new breeding lines with good late-blight resistance ready for distribution.

CIP scientists are working with researchers and extension organizations in farmer field schools to help producers test these potatoes under diverse local conditions. In these open-air classrooms, farmers also learn how to make better decisions about crop management.

Fungicides are the most commonly used late-blight control measure. But these chemicals, especially when used indiscriminately, are expensive and damaging to human health and to the environment. In the field schools, farmers learn how to apply fungicides in combination with other measures, minimizing their use and maximizing their benefits. Each farmer field school curriculum is carefully adapted to the location where it is applied. This means looking at late blight in the larger context of integrated management of other important locally occurring pests and diseases, such as bacterial wilt.

The field school approach has added benefits. It builds relationships among research institutions, extension organizations and farmer groups by encouraging them to work together to provide growers with information, technology and tactics for confronting agricultural problems. At the same time, the feedback from the schools gives researchers added insights into the performance of potato genotypes in diverse environments. This, in turn, contributes to late-blight breeding programs and to the further development of integrated disease management strategies.

by no means meets the demand for clean seed nationwide. Experts hope the UNSPPA model can be replicated in potato growing districts throughout the country. A recent three-year, US$30,000 grant awarded to the association will help. The grant is part of a technology-transfer program implemented by CIP on behalf of the Association for Strengthening Agricultural Research in Eastern and Central Africa.

Spreading the work

Meanwhile, a few handpicked UNSPPA members have begun to produce basic seed themselves using stem cuttings from mother plants. Among them is association founding member and treasurer, Ponsiano Santaro.

"I'm expecting to get at least 15 bags of pre-basic seed," he says. Santaro will then replant that seed to produce 75 bags of basic seed, which he can sell to other association members at 40,000 shillings (US$24) per bag.

Santaro started with 40 mother tubers produced by NARO from pathogen-tested material supplied by CIP. With these, he followed a method that has now become routine. He plants the tubers in small piles of virgin soil a meter apart. After six weeks, when they have sprouted stems to 15 cm, he cuts the tips to encourage branching of shoots. Then,

after another week or two, he clips the new branches and plants the resulting shoots in a nursery area. He waits another couple of weeks before transferring these plants to the garden where, after three to four months, they yield basic seed.

The method has been very successful for Santaro. When the town-based businessman decided to go into potato farming, he could not get good seed from local markets and only managed to grow enough potatoes for home consumption. Now, things have changed. Last season, Santaro made a profit of US$750 from seed alone.

The power of knowledge

NARO–CIP farmer field schools also have helped spread the word about the importance of clean seed, disease management and suitable cultural and post-harvest practices. “We were producing in an ad hoc manner,” says one farmer-pupil, Juliet Sanyu. “Now we have learned how to select seeds and how to plant in rows to manage our fields. We are also learning that it is important to produce quality seed.”

Before, using market seed Sanyu would get barely profitable yields of just 2.5 times what she planted. She often lost much of her crop to bacterial wilt, late blight, and other problems. Since October 1999, however, Sanyu has been producing enough to start selling commercially. “We were ignorant about sources of clean seed,” agrees Peninah Arinaitwe, who attended the farmer field school in her village of Nyamiyaga and since has managed to buy two cows with her profits from potatoes. “We would go to the market and buy whatever was available. We didn’t know we could get clean seed. Now other people are realizing that I am producing a really good crop. They are appreciating the value of buying good seed.”

Farmer Kemmani Erinao has also learned how powerful a little bit of knowledge can be. He used to lose half of the potatoes he saved for seed because he kept them on the ground. Last year, he spent US$360 on materials and four months of his own time to build a storage hut. He modeled it on one of the 76 community diffused-light stores built in the past few years by local farmer groups with technical help from AFRICARE through its Uganda Food Security Initiative. More than 100 community groups are producing quality seed for their own use through this program.

Now, says Erinao, “people are even coming from other villages to buy because they know I have good seed.” For him, as for many other African farmers, quality is convincing.

— reported by Mike Crawley

IPM TOOLS: NEW ALLIES IN AN OLD BATTLE

What do you get when you dangle a battered beer can on a stick? It may sound incredible, but the answer is the single most important component in farmers' fight to control the sweetpotato weevil in Cuba.

Grown on 60,000 hectares across Cuba, sweetpotatoes contribute precious calories and vitamins to a needy population. That's why, when in 1993 Cuba was suddenly cut off from the pesticide imports it had depended on for years and weevils devastated the country's crop, Cuban researchers began to search for natural, inexpensive and easy ways to manage the pest.

The problem started with the collapse of the Soviet Union in the early 1990s. Without Soviet-provided inputs, defenses went down in Cuban fields and the sweetpotato weevil — *Cylas formicarius,* an imported insect with few natural enemies — faced little opposition. In 1990 average losses for cooperatives, private farms and state enterprises in their sweetpotato fields had been less than 10 percent. In 1993, the figure jumped to more than 50 percent. But by 2000, the tables had turned again, the weevil problem was under control, and damages were virtually nil. What made the difference?

NEW AGE

In 1993 CIP and INIVIT, Cuba's Instituto de Investigación de Viandas Tropicales, joined forces to develop a comprehensive plan of attack against *Cylas*. A return to pesticides was not only unlikely — it was not desirable. It was the beginning of a new age for Cuban farmers, and pesticides were not to be part of it. Instead, natural solutions were the aim.

"I DON'T NEED PESTICIDES ANY LONGER, AND I WON'T GO BACK TO THEM AGAIN."

Farmer Pedro Saez reflects on the pesticide-dependent era as he contemplates the healthy sweetpotato fields on his farm in Manacas (Villa Clara Province).

"I don't need pesticides any longer, and I won't go back to them again," he says. According to a joint CIP-INIVIT survey conducted in 2000, virtually all the Cuban producers agree.

Saez began working with predatory ants, soaking bunches of dried grass in sugar water and leaving them in his plantain fields. Two days later,

when the grass bundles were covered with ants, he took them to his sweetpotato fields, where the ants feasted on weevil eggs and larvae.

Over time Saez has discovered that around 25 of these ant deposits will do the job on one hectare of sweetpotato. Once the crop is harvested, the ants will move on to the nearest field where sweetpotato, a year-round Cuban crop, is grown.

Saez gets additional support from the fungus *Beauveria bassiana*, now produced all over the island. Although this fungus is totally harmless to plants, humans and animals, a small dose spread over infested fields can be fatal to a good part of the *Cylas* population within a week.

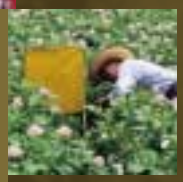
Farmer Alfredo Acosta, President of the Heroes de Yaguajay cooperative in the Alquizar municipality (Havana Province) remembers his worst harvest. "In 1992 our losses from weevil attacks amounted to 60 percent of our harvest. And our cooperative," and the agricultural ministry officials around the table nod in agreement, "is, by Cuban standards, one of the best."

He found a few things to fall back on: traditional crop management techniques and INIVIT's sound recommendations, among them, the use of irrigation. Dry, cracked soils make it easy for weevils to lay their eggs directly on sweetpotato roots. Acosta was also advised to rotate crops and never plant his crop next to another sweetpotato field. Even so, he — like many other Cuban farmers — suffered terrible losses.

Acosta, nonetheless, was initially skeptical about the new devices, known as weevil traps, that INIVIT and CIP were promoting. "I saw them in other producers' fields and there were lots of weevils around them. I was afraid they might actually harm my crops. It looked to me like a bad idea," he recalls. But as the economic crisis persisted, he felt obliged to give the traps a try. Today, the cooperative's 60 hectares of sweetpotato fields yield a healthy 30 tonnes per hectare, way above the national average of 6-7 tonnes.

Nilo Maza Estrada, an INIVIT economist, agrees that 'trap' might not be the best word to describe

Putting it all together



If pests are one of the biggest problems for the world's poorest farmers, integrated pest management has been one of the most productive areas of collaborative research between CIP and developing-country research programs. The success of an IPM program is based on solid knowledge of the pest in question: how it feeds, grows, reproduces, disperses, and the variables of its habitat. Based on this knowledge, management techniques are developed to exploit vulnerable points in the insect's behavior and life cycle.

Because educating farmers about pest management principles is often as important as teaching specific practices, IPM researchers involve farmers in technology adaptation and innovations, ensuring, in the process, that the solutions developed are user-acceptable. The goal is to enable farmers to both manage pests and protect the environment by using a range of tools that are effective, economically acceptable, safe, and easily adapted to local production systems.

The first step in making it all work is to assess needs and opportunities in a selected agro-ecosystem. Then, control methods are developed, integrating information generated through biological, agronomic and socio-economic research with management tactics. Next, tools for disseminating information and mechanisms for working directly with farmers in their fields are formulated using participatory approaches. Finally, the last step — and the one that can make or break an IPM program — is to promote the institutionalization of large-scale implementation programs throughout the locality in question.

what the beer cans do. "The cans are bottomless and will catch nothing. But inside there's a small, red plastic disc on a string. That disc contains a 0.25 mg dose of pheromones with a smell that resembles the mating signals of a female *Cylas*." The beer can merely provides protection against the sun and the rain; in other locations it is substituted by a small piece of wood for roofing.

Pheromones are used in combination with the *Beauveria* fungus, which is heavily sprayed in the few square meters around the traps. When male weevils swarm around the traps in search of females and alight on nearby plants, they encounter the fatal fungus. The ideal number of traps is 16 per hectare, but farmers often use fewer, moving them around the field every week. The effect of the pheromones lasts three to four months, a whole sweetpotato-growing season.

Acosta and farmers like him are now convinced of the effectiveness of these traps. Even so, there remains one challenge: to find a means of guaranteeing stable supplies of pheromones, the most expensive of the control agents.

More to come

Meanwhile, other options are also being explored. Cristóbal Yera, in charge of one of the big state agricultural enterprises in Santo Domingo (Villa Clara Province), is staking his bets on an important component of the integrated pest management,

Breaking out of vicious circles

Integrated pest management provides critical support to farmers who need to increase their crop productivity. Control methods and approaches initially developed by CIP for work with the potato crop have been readily adapted for use with sweetpotato, and are proving their worth worldwide. Several of the articles in this Annual Report illustrate this contribution in Asia and Latin America.

In East Africa, sweetpotato is an important staple and has great potential as a cash crop. But there are a number of limiting factors that keep this crop from making its full contribution to diets and pocketbooks, including weevils, moles, drought and low soil fertility. CIP and local researchers are looking at the entire sweetpotato production enterprise to develop effective, integrated crop management measures.

One of the major limitations to sweetpotato production in East Africa is the tuber's low market value. Because it is considered a marginal crop, farmers invest little in crop management, and losses to weevils and moles increase. This, in turn, reinforces people's perception of sweetpotato as a subsistence food, creating a vicious circle that lowers demand even further.

CIP's sweetpotato IPM work in East Africa involves the development of better, high yielding varieties, as well as research on soil fertility, drought, and market and post-harvest practices. In this way, scientists aim to help sweetpotato growers appreciate this crop's full potential as a source of healthier diets and improved livelihoods for themselves, their families and their communities.

or IPM, tool box: his seed bed. Sweetpotato is reproduced with stem cuttings. Traditionally, the cuttings are made at harvest time to ensure that the plant has completed its productive cycle. The risk of transplanting stems infested by weevils, however, is higher at this time.

Yera explains the alternative: "Now we plant a smaller area and make cuttings from plants only half way to maturity, when infection by weevils is not so advanced and the cuttings are very vigorous. By making the cuts at the top of the plants we reduce the risk of infection even further."

A bonus to this system is that harvest and planting don't coincide, meaning less of a labor problem. Previously, producers would get around this problem by storing their harvest in the soil until they could find time to take it to the market. Farmers now know that the longer the crop stays in the ground, the higher the risk of weevil damage.

The IPM tactics recommended by INIVIT and CIP also include disinfection of cuttings, elimination of weeds that host the weevil, and removal of leftover roots and plants from harvested fields. Not all producers put all the components into practice. From among them, farmers pick and choose the set of techniques that works best for their farms, their labor capacity – and their pocketbooks.

To help make those choices simple, CIP and its Cuban partners have put together an easy-to-understand booklet on the good and bad guys in

the sweetpotato weevil drama, presented as cartoon figures. The villain is the black sweetpotato weevil. The cops cleaning the sweetpotato rows are two predatory ants (*Pheidole megacephala* and *Tetramorium guineense*) and the *Beauveria bassiana* fungus. The smoking gun is the ragged beer can.

Measures of success

INIVIT and CIP researchers gathered facts and figures about the impact of this work in a study published in 2000. The economists were cautious in defining the criteria used to measure success, but, even so, the figures spoke eloquently. The return on the research investment was calculated to be at least 49 percent — by the most conservative standards — and as high as 73 percent. All in all, there was no doubt about the value of the work for Cuba's economy, which has gained an estimated US$31 million in increased yields, reduced losses and market value.

Aside from the economic returns, there have been important health and environmental benefits. In 1990 farmers sprayed their fields with highly toxic imported pesticides 12-15 times each growing season. Today, they use none.

Meanwhile, scientists continue to breed new and better sweetpotatoes that can resist weevil attacks and boost yields. They are seeking to develop plants with deeper, harder-to-get-to roots and slimmer stems, which are less attractive to the weevils. A promising candidate from combined INIVIT-CIP germplasm has already been identified. In trials, without other control measures, it yields 34 tonnes, with weevil loss at only 4 to 5 percent.

One of the most rewarding aspects of this IPM work, according to INIVIT director Sergio Rodriguez Morales, has been the collaboration between CIP and INIVIT researchers: "It is a model of true partnership among my staff and the CIP researchers. Both sides can take pride in their results." Cuba's appreciation for their efforts, he points out, was officially acknowledged with a special award of 'relevance to the nation'.

— reported by Ebbe Schiøler

ARRACACHA: A LOST CROP FINDS ITS WAY TO THE MARKET

Artemio Burga farms 2.5 hectares of steeply sloping land in the village of Mangallpa, in the northern Peruvian Department of Cajamarca. His hillside farm is typical of those in his village: a patchwork of garden-sized plots of potato, maize, cassava, sweet-potato, beans, sugar cane, cabbages, peas, carrots and a parsnip-like root crop called arracacha.

"Arracacha has always been around," says Burga, 73. "Until recently, we grew it because our parents and grandparents grew it. We didn't know anything about the different varieties, or how to get the highest yields. We never really thought much about it at all."

This and several other root and tuber crops were a mainstay of ancient Andean civilizations. Developed over centuries by highland farmers, they have recently lost ground to more commercial crops, leading them to be dubbed 'the lost crops of the Incas'.

Now, arracacha is at the heart of a three-country, multi-institutional effort to preserve the diversity of native crops while promoting community-level agro-industry in the Andes. As a result, the root crop is undergoing a double transformation. Not only is it being prepared for introduction into regional and national markets; it also is taking on a new importance among the people who grow and consume it. Subsistence farmers who never thought twice about arracacha are beginning to see it as a step on the path toward a better future.

"We'll be planting another one-third of a hectare in the next few days," confirms Burga's 42-year-old son, Segundo, as he surveys a freshly plowed field on the farm he shares with his father. "If it's as profitable as we hope it will be, we can start to think about sending one of our children to high school. Right now there is no way we can afford it."

"THE IDEA IS TO EMPOWER PRODUCERS AND LOCAL INSTITUTIONS TO TAKE ON THESE CHALLENGES THEMSELVES."

The project was conceived and organized by the Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN), of which CIP is a founding member. The initiative is grounded on strategic alliances at the regional, national and local levels, permitting a concerted response to a complex set of conditions and challenges.

"This project covers the whole chain, from genetics, to agronomy, to engineering, to economic development," says project coordinator and CIP

post-harvest production specialist Sonia Salas. "When you are dealing with issues as complicated as these, you can't really separate research and development. In each place, you try to bring all the institutions together to make the system work in an integrated way."

A REGIONAL MODEL

"The arracacha project is an excellent model," says CONDESAN's Elias Mujica. "There are some 800,000 small-scale agro-indutrialists in the Andes, making everything from cheese and biscuits to honey and jam. The products may be different, but the producers' needs are similar. They have to modernize production, to make high-quality products, to make consumers aware of the products, and to maintain genetic diversity. They also have to make sure that the bulk of the profits don't go to middlemen."

To do all that, Salas says, requires a level of organization that doesn't generally exist in poor rural communities. "That's why it is so important to include a wide range of actors — from scientists and development specialists to small-scale merchants and farmers. The idea is to empower producers and local institutions to take on these challenges themselves."

Researchers and development institutions throughout the Andes are getting the message. When CONDESAN's electronic information arm, InfoAndina, used the arracacha project as a model in a regional 'electronic forum' on rural agro-industry, more than 500 people in 21 countries joined in the debate. One of the themes was the role of agro-industry in the conservation of biodiversity. Historically, industry-oriented agriculture tends to displace genetically diverse traditional cropping systems with monocultures based on new, 'improved' crop varieties. This agro-industry project, however, is linked to a larger CIP project aimed at conserving and utilizing Andean biodiversity.

"Big factories demand regular inputs, which means they want genetic uniformity in their raw materials," Salas explains. "But our hypothesis is that

Poised for a comeback

Arracacha (*Arracacia xanthorrhiza*), a relative of both carrots and celery, is a little known food that is considered by researchers to be one of the most promising of the nine minor Andean root and tuber crops conserved and studied by CIP.

Arracacha roots have a pleasant texture and flavor that combine well with other foods. They are easily digestible; produce a fine, high quality starch; and are rich in calcium, iron, phosphorous, beta-carotene and vitamin B. Their main drawback is their short shelf life, and their vulnerability to damage during transport.

Although arracacha is best known for its roots, no part of this plant goes unused. The stems and leaves are fed to livestock. The anti-oxidant-rich leaves also have many traditional medicinal applications.

CIP scientists estimate that about 30,000 hectares are devoted to arracacha cultivation in South and Central America. In Venezuela, where it is known as *apio*, arracacha is considered a delicacy, as well as an ideal food for weaning infants. In Brazil, fresh arracacha commands relatively high prices in urban supermarkets, while arracacha starch is widely used in processed baby foods and instant soups.

Spanish chroniclers reported that arracacha was important among 16th century Peruvians, but today it is virtually unknown outside of a few remote mountain areas. One of the main challenges for arracacha's promoters is to raise the root's profile, and the place to begin is at home.

"We used to put arracacha in soups and stews, but that was all." says Doralisa Llatas of Sucse. Now she counts 16 arracacha dishes in her village alone, with more being invented all the time.

small-scale, rural agro-industry, which isn't so highly mechanized, can actually enhance diversity. That should be especially true where the raw materials are little-known native crops like arracacha."

"Equally important," adds Salas, "is the fact that agro-industry generates added value, income and employment in rural areas. This makes it a powerful weapon in the war on poverty."

Simple changes

In Ecuador, the arracacha project is centered in San José de Minas, about 90 km from Quito. In Bolivia, the work is being carried out in San Juan de La Miel, 100 km from La Paz. In both cases, fresh arracacha enjoys a small but established niche in nearby urban markets.

Farmers are working to identify and select desirable varieties, produce disease-free planting material, modernize their cultivation methods, and reduce post-harvest losses that often approach 40 percent. Communities are also establishing on-farm collections of arracacha — a vital step toward conserving the diversity of native varieties.

"Just by making a few simple changes in the way they manage the crop, farmers have been able to more than double their productivity," reports Fausto Do Santos, an agronomist from The Brazilian Agricultural Resesarch Agency (EMBRAPA) who was

invited by CIP to work with producers at the project sites. Do Santos has shown farmers how to improve soil preparation, create seedbeds, produce better cuttings, and space plants more efficiently. Not only have yields increased dramatically; the plants have also begun to produce straighter, more uniform roots, a major advantage for shipping and handling.

The project also has sponsored food fairs to spur local culinary interest in the crop. Farmwomen have presented a variety of dishes to what has been, by all accounts, a highly approving public. Now tourist hotels near the project site in Bolivia are offering arracacha specialties on their menus.

Almost market-ready

In Peru, the arracacha project goes one step further. There, farmers are making the same sorts of agronomic improvements as those in Ecuador and Bolivia. But they are also launching the commercial production of a local specialty called *rallado de arracacha*, a sweet sticky paste made from grated arracacha cooked in sugar cane syrup.

For generations, *rallado* has been prepared in small quantities in individual households, mainly for consumption as a special dessert during local festivities. Only a tiny fraction found its way to village markets, and even less made it as far as the closest urban centers. *Rallado* was typically packaged in a

Solutions On-line

The story on arracacha processing describes how the InfoAndina electronic network helped to provide valuable input to this project through Internet-based discussions. More recently, CONDESAN used a similar strategy to help Bolivia harmonize the debate over national water-use legislation.

Bolivia's government, like many in the region, is privatizing services such as telephones, railroads, and electricity. Creating a concession for water, however, has turned out to be more complicated, largely because it involves accommodating age-old practices, as well as resolving diverse conflicts of interest.

To address the need to involve civil society in the decision-making process, nine Bolivian CONDESAN members created a forum to deliberate water issues. This local forum has grown into the Commission for the Integrated Management of Water in Bolivia (CGIAB).

CGIAB used InfoAndina-pioneered methodologies to develop a weekly e-mail newsletter, which now has 900 subscribers, and a website, www.aguabolivia.org.

The site has hosted several electronic fora, including an innovative program of weekly debates in the Bolivian parliament on key water issues. These Internet-based debates have enabled long-distance participants to join in. The Commission is also designing radio spots and Sunday newspaper supplements, and has expanded its website to include hydrological information, examples of water legislation from neighboring countries and a search engine to access the over 3,000 Bolivian newspaper articles they have on line.

banana leaf without a label and the quality of the product was variable, to say the least.

Yet all indications are that *rallado* has tremendous market potential. Detailed surveys conducted by Salas' team in Lima and the northern coastal city of Chiclayo have shown it to be highly appealing to urban consumers. Mothers have reported a serious interest in *rallado* for inclusion in their children's school lunches. The dessert was even received with enthusiasm in Paris, where it was introduced at a major international fair.

For farmers, this is excellent news. Processed *rallado* is easy to transport and has a shelf life of six months, compared to just a week for fresh arracacha.

A COMMUNITY CORPORATION

Working with a Peruvian NGO, Farmer Schools for Education and Health (ESCAES), Salas and her colleagues have helped families from two villages organize a legally recognized, community-owned business to produce and market *rallado*. The villagers have built a model processing plant in Sucse, a district of Sócota, Cajamarca.

"The idea of the plant is to improve the last steps of the process to meet exacting sanitary standards and satisfy consumer preferences," says Salas. Producers are learning about quality control, packaging, and marketing. The hope, Salas says, is that they can take what they learn here and apply it to other activities. One of their most important lessons is that there are benefits in working together.

"The producers are changing their mentality," Salas observes. "People who thought only as individuals are now thinking of how they can join forces to reach bigger and better markets."

"This project is more than just the logical outcome of all the research that has been done by CIP and others on arracacha; it is a fundamental part of that research," says Gilberto Coronado, coordinator of the local office of ESCAES. "Commercialization is a crucial part of the chain of production."

Early results have been encouraging. Market prices for *rallado* have doubled since the project began, thanks to improved quality and interest. Local producers are optimistic that more good things are coming.

"This is a change for us," says Roberto Castillo, a 37-year-old owner-member of the *rallado* company, "My wife and I have been talking for a long time about how to improve things for our two-and-a-half-year-old daughter. To get ahead with our farming, we'd need more land and more money for inputs. Unfortunately, we don't have more land or money. With the *rallado*, we can take advantage of what we already have."

— reported by Jon Miller

In brief

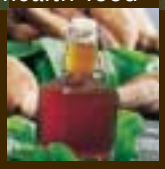
Prize for agro-industrial innovation

CIP and the Universidad Nacional Daniel Alcides Carrión of Oxapampa (Peru) won first prize in the Peruvian ITA-2000 competition for agro-industrial technological innovation (Concurso de Innovación Tecnológica Agroindustrial 2000).

The award recognizes their work in developing a rural pilot plant for production of yacon syrup using simple technology, in collaboration with the recently established association of yacon growers in Oxapampa.

The yacon-processing research began early in 2000 when CIP scientists discovered that palatable syrup could be made from the purified juice of this Andean root crop in a straightforward process resembling the production of raw cane sugar. Yacon, little known outside the Andes, contains high concentrations of fructans (polymers of fructose).

These non-caloric sweeteners are attractive to diabetics and dieters. They also stimulate the growth of beneficial bacteria (pro-biotics) in the human colon. Because of these unique properties, researchers are convinced that yacon syrup will readily find a niche in the booming health food market — both locally and abroad — making an important contribution to alleviating rural poverty in the Andes.



The sponsors of ITA-2000 included the Food and Agriculture Organization of the United Nations (FAO), as well as the Peruvian Universidad del Pacifico and INDECOPI (Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual). The US$8,000 prize money will be used for future development of the processing plant.

Improved management reduces health risks

CIP and local collaborators are helping potato-farming families in Ecuador to reduce risks of poisoning from the pesticides they use on their crops. The researchers are working with 60 farm families in three villages in El Carchi Province, teaching them integrated pest management measures to lessen their dependence on pesticides, as well as methods of handling these chemicals safely.

In recent studies, CIP scientists have confirmed that potato tubers themselves are not a source of contamination: tests showed that even unpeeled, uncooked potatoes did not have significant levels of pesticide residues. This points to exposure as the probable cause of pesticide poisoning. El Carchi farmers, experienced potato growers, know the correct pesticides to buy for particular pests and diseases. They also have a strong sense that these chemicals can be dangerous. Even so, the practices they use to administer pesticides often put them at risk. The farmers mix pesticides in the open — in old oil barrels, for instance — and apply them using hand-pump backpack sprayers. Because farmers use little or no protective clothing when they spray, most work-related exposure is on the skin of the hands and lower back.

But the damage does not stop there. The chemicals often pollute household water sources during equipment cleanup, and family and friends can be contaminated through personal contact with the farmers who have been spraying (before they wash), or with clothing hung up inside the house.

CIP researchers used harmless fluorescent tracers to demonstrate the dangers of poor handling practices and the importance of personal hygiene to the families in Ecuador. This will help to reduce

risks, while researchers continue to seek means of lowering pesticide use through effective integrated pest management.

TPS benefits 100,000 farm families in Vietnam

Over the past seven years, nearly 100,000 rural households in the Red River Delta of northern Vietnam have been planting their potatoes using true potato seed (TPS). According to a recent impact study, the farmers using this technology have seen their potato yields increase by 6.8 t/ha, or 75 percent, compared to yields from the locally available alternative: old, degenerated tuber seed. By 1999, small farm families were planting TPS on 3500 hectares, about 10 percent of the total potato area in Vietnam, and net household income among the TPS adopters is estimated to have increased by US$10-15 (enough to buy about half a year's supply of rice for one person).

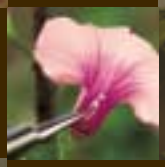
TPS crops are grown mainly in the winter, non-rice-growing, season, when men of farming families migrate to the towns in search of off-farm work. Because of this, they are produced largely by women, who are deeply involved in the promotion and transfer of TPS technology in the Red River Delta. And because it is mainly women who perceive the income increase from TPS, researchers expect — based on past studies of gender-related spending — that a relatively large share of this income is devoted to childcare and other direct household improvements.

Aggregate economic benefits from TPS in Vietnam are estimated at US$1.075 million per year. This technology has played a key role in meeting the demand for quality potato seed in the country, and is expected to continue as a viable alternative for at least another decade, until clonal seed sources become more reliable. A new potato variety, KT-3, developed from CIP material by the national program in Vietnam, shows great promise for filling the seed gap. KT-3 was officially released as a new variety in 2000.

Assessment of sweetpotato genetic diversity

CIP holds an important collection of sweetpotato genetic material in trust for use in crop improvement worldwide. Assessment of the diversity of this germplasm is important for the design of CIP's core collection and for facilitating the material's use. During 2000 CIP and its collaborators made valuable progress in several areas.

A molecular marker system (S-SAP) originally developed for potato was adapted for sweetpotato by CIP collaborators at the Austrian Research Centers Seibersdorf. This new system will be used to study the recent evolution of the sweetpotato genome in its secondary distribution areas (Africa and Asia), and will also be useful in genetic mapping. S-SAP markers have potential for certifying geographic origin, and can be used, for example, to reconstruct dispersal routes within East Africa.



Using amplified fragment length polymorphism (AFLP) analysis, CIP and its collaborators at Hong Kong University have studied germplasm from Asia and Oceania (the collection previously held by the Asian Vegetable Research and Development Center in Taiwan). Analysis of this material revealed a high level of genetic diversity, comparable to that in central and northwestern South America, and

showed that sweetpotatoes from New Zealand, Philippines, Solomon Islands and Tonga were closely related to germplasm from Mesoamerica. Microsatellite DNA marker analysis in tropical American germplasm confirmed that Mesoamerica has the highest inter- and intra-specific sweetpotato diversity and most likely is the center of origin for this crop.

Restoration of native potatoes

Some varieties of native Andean potatoes are now extinct, and we are in danger of losing more. CIP is helping to avoid this tragedy. Farmers in the Andes have long known that native potatoes taken from colder, higher altitudes (above about 3500 m) initially show good vigor and yield when grown at lower altitudes. Over a few seasons, however, vigor and yield decline, and new seed must be brought from the higher altitudes. We know now that the gradual yield reduction observed by farmers at moderate altitudes can be attributed in large part to the accumulation of viruses. At colder, higher altitudes there are few virus vectors, so there is little viral infection of the plants.

CIP has embarked on a program of restoration of native potatoes based on age-old Andean farmers' practices. CIP cleans seed through virus testing and elimination, and then supplies it to farmers who take it to high altitudes for multiplication. In 2000, healthy clones of 496 native cultivars, including some considered 'lost', were returned to nine farmer communities in central Peru. From an earlier CIP repatriation of native potatoes, farmers in San Jose de Aymará, at 3850 m altitude, have added 244 healthy cultivars to the material being conserved in their communal seed bank.

Sweetpotato cultivar development

Five elite African landraces of sweetpotato are ready to be distributed to growers in Kenya following several years of participatory, multi-locational evaluation trials by CIP and local farmers. In November 2000 the national sweetpotato variety-release committee recommended the release of KEMB 10, SPK 013, SPK 004, KSP 20 and Mugande.

Since 1996 when this project started, CIP and its national agricultural research partners have had numerous successes: 12 varieties were released in Bangladesh, Indonesia, Peru, Uganda and Vietnam; five varieties are in the process of being released in Uganda; and 20 to 30 promising clones have gone through advanced trials and are now being tested on farms in Africa and Asia.

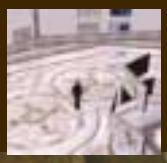
In addition, at CIP's headquarters in Lima, Peru, the combination of parental clones with diverse genetic backgrounds has yielded a group of high dry matter clones with orange or dark yellow flesh. These sweetpotatoes have good potential in Sub-Saharan Africa because they provide a rich source of pro-vitamin A and have the bland, starchy taste preferred by African consumers.

Virtual laboratories

At the invitation of the CGIAR System-wide Livestock Program (SLP), CIP is leading an initiative to create a 'virtual laboratory on systems analysis'. Virtual laboratories are electronic workspaces that

permit distance collaboration and experimentation in research, as well as other creative activities, to generate and deliver results using distributed information and communication technologies.

The rapid growth of virtual laboratories (VLs), made possible by advances in high-speed digital communications, has brought about major changes in the way we do science. Researchers can now address forefront research issues with greater efficiency and less movement of personnel than was previously possible.



The first step towards creating the CIP-led VL for systems analysis was taken at a consultation meeting held in Lima in November 2000 and attended by scientists from Bolivia, Chile, Ecuador, Ethiopia, Italy, Peru, UK and USA. The CEO of Active Worlds, one of the leading providers of virtual worlds, also participated.

After the workshop, a prototype of a virtual world linking biophysical models with virtual reality was created and presented to the SLP, together with a proposal for its further development. The SLP made funds available to create the first VL in the CGIAR system — a project that will start in 2001 with the participation of several Future Harvest centers, national agricultural research institutions and advanced research institutes.

Indonesian sweetpotato germplasm on CD-ROM

Over the past 10 years, CIP and partner institutions in Indonesia have carried out an extensive, nation-wide project to assemble a comprehensive collection of sweetpotato germplasm, and to preserve the indigenous knowledge associated with this crop. Full documentation of the collected germplasm, distributed in genebanks throughout the country, and the associated information are now available on a CD-ROM.

The project was conducted in several stages. A collection of lowland sweetpotato genetic resources, mainly from Java and Sumatra, was assembled in Bogor, West Java, beginning in 1991. Collecting in the genetically rich Irian Jaya Province began in 1992 and expanded after 1993. To accommodate this material, a new highland field genebank was established under CIP's curatorship at the Research Institute for Vegetables in Lembang, West Java.

More recently CIP has helped the Rootcrops and Sago Research Center of Irian Jaya's Cenderawsiah University to establish a core sample collection of the province's sweetpotato cultivars at Anggirai (western Irian Jaya), at 1895 m altitude. Main curatorship of the Java-based collections has now passed to the Research Institute for Legumes and Tuber crops in Malang, East Java, and the Research Institute for Food Crops Biotechnology in Bogor; CIP-managed collections in Bogor and Lembang remain as back-ups. In addition, on-going research with farmers in Irian Jaya is assessing the use of in situ management as a complementary conservation strategy.

The CD-ROM, *Guide to Indonesian sweetpotato genetic resources*, contains a searchable catalog of 1522 accessions, together with images and maps. It provides the first extensive information on the spatial distribution of sweetpotato germplasm in Indonesia and its morphological and agronomic attributes, as well as indigenous knowledge associated with the crop, much of which is in danger of being lost due to the socio-economic and agricultural changes taking place in the country.

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IN MEMORIAM

Dr M Sujayet Ullah Chowdhury (1940–2001)

It is with great sadness that we report the death of Dr M Sujayet Ullah Chowdhury on 14 March 2001. Dr Chowdhury joined CIP's Board of Trustees in 1997 and in 2000 was reappointed to serve for a second term. His death came only a few days before he was due to join his colleagues at the 2001 Board meeting.

Before joining CIP's Board, Dr Chowdhury served as Chief Executive Officer and Executive Chairman of the Bangladesh Agricultural Research Council (BARC).

Dr Chowdhury was a most conscientious member of CIP's Board and, especially in his work with the Finance and Audit Committee (of which he was appointed Chair in 2000), he contributed much to the welfare of CIP. His interventions at Board meetings were always thoughtful and measured; they showed a wealth of experience and practical insight into the role of a center such as CIP in assisting developing country agriculture.

Dr Chowdhury is survived by his son Enam and daughter Sheila, to whom we extend our deepest sympathy.